REMARKS

The Office Action dated December 23, 2009 has been received and carefully noted. The above amendments to the claims, and the following remarks, are submitted as a full and complete response thereto.

Status of the Claims

Claim 1 has been amended to more particularly point out and distinctly claim the subject matter of the invention. No new matter is believed to have been added. Claims 1-12 are currently pending and are respectfully submitted for consideration.

Reconsideration and withdrawal of the rejections is respectfully requested in light of the following remarks.

Rejections under 35 U.S.C. § 103

Claims 1, 4, 6, and 7 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Asano (U.S. Patent Publication No. 2004/0054531). Applicants respectfully traverse this rejection.

Claim 1, upon which claims 3, 4, 6, and 7 are dependent, recites an automatic speech recognition system, which recognizes speeches in acoustic signals detected by a plurality of microphones as character information. The system includes a sound source localization module configured to localize a sound direction corresponding to a specified speaker based on the acoustic signals detected by the plurality of microphones. The system includes a feature extractor configured to extract features of speech signals included in one or more pieces of information detected by the plurality of microphones.

The system includes an acoustic model memory configured to store direction-dependent acoustic models that are adjusted to a plurality of directions at intervals. The system includes an acoustic model composition module configured to compose an acoustic model adjusted to the sound direction, which is localized by the sound source localization module, based on the direction-dependent acoustic models in the acoustic model memory. The acoustic model composition module also configured to store the acoustic model in the acoustic model memory. The system includes a speech recognition module configured to recognize the features extracted by the feature extractor as character information using the acoustic model composed by the acoustic model composition module. The acoustic model composition module is configured to compose an acoustic model for the sound direction.

As will be discussed below, Applicants respectfully submit that Asano does not disclose, either expressly or implicitly, all of the features of the present claims.

Asano describes speech recognition apparatus and a speech recognition method for speech recognition with improved accuracy. A distance calculator 47 determines the distance from a microphone 21 to a user uttering. Data indicating the determined distance is supplied to a speech recognition unit 41B.

Paragraph [0127] of Asano provides that, in general, the user most likely utters from a direction perpendicular to the face of robot. Thus, it is assumed herein that the CCD cameras 22L and 22R taking images of the user used in calculation of the distance to the user are located in the head unit 3 (FIG. 2) so that the images are taken in the

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direction perpendicular to the face of the robot. Paragraph [0129] of Asano describes that the robot may include a plurality of microphones, and the *direction of the sound source may be estimated from the power difference or phase difference* among the speech signals detected by the plurality of microphones. (Emphasis added) However, Asano does not teach or suggest that a sound direction is localized "corresponding to a specified speaker *based on the acoustic signals detected by the plurality of microphones*," as recited in independent claim 1. Rather, as clearly indicated in Asano, the direction of the sound is <u>estimated</u> from a power difference or phase difference.

Also, paragraph [0129] of Asano provides that the speech recognition is performed on the speech data output from a microphone having a greatest speech level (in the case in which the robot moves until the robot faces in the direction of the user, a microphone disposed in the same direction perpendicular to the face of the robot is employed). However, similar to other portions of Asano, there is no description in Asano to localize of a sound direction based on the acoustic signals detected by a plurality of microphones. Therefore, Asano does not teach or suggest the features associated with the sound source localization module recited in independent claim 1.

Paragraph [0104] of Asano describes a feature extractor 101 performs acoustic analysis on the speech data supplied from the analog-to-digital converter 12 on a frame-by-frame basis to extract feature vectors as feature values such as MFCC (Mel-Frequency Cepstrum Coefficients). Paragraph [0106] describes that time sequence of feature vectors in a period (speech period) from the start of utterance to the end thereof is stored in the

feature vector buffer 102. However, contrary to the contentions made in the Office Action, Asano does not teach or suggest "an acoustic model memory configured to store *direction-dependent acoustic models* that are adjusted to a plurality of directions at intervals," emphasis added, as recited in independent claim 1. There is no teaching or suggestion in the portions of Asano referred to by the Office Action of direction-dependent acoustic models. On the contrary, in paragraphs [0131]-[0133], Asano specifically describes that a set of acoustic models for a distance is stored. There is no description in Asano that would lead a person of ordinary skill in the art to configure storing direction-dependent acoustic models.

In addition, paragraph [0131] of Asano describes that if the selection controller 108 receives the data indicating the distance to the user from the distance calculator 47 (FIG. 3), a distance D_n closest to the distance to the user is selected from N distances D_1 to D_n, and an acoustic model database 104_n in which a set of acoustic models for that distance is stored is selected via the selector 109. That is, under the control of the selection controller 108, the selector 109 selects the acoustic model database 104_n, acquires the set of acoustic models for the distance D_n closest to the distance to the user, and supplies the acquired set of acoustic models to the matching unit 103. Thereafter, process proceeds to step S4. Asano does not teach or suggest "an acoustic model memory configured to *store direction-dependent acoustic models that are adjusted to a plurality of directions at intervals*," emphasis added, as recited in independent claim 1. There is no adjustment described in Asano of the acoustic models. Other than storing, selecting,

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acquiring, and supplying a set of acoustic models for distance, nothing in Asano describes that the set of acoustic models are adjusted to a plurality of directions at intervals.

Paragraphs [0132]-[0133] of Asano describe that the matching unit 103 reads, from the feature vector buffer 102, the feature vectors extracted from the speech data in the speech period and calculates language scores and the acoustic scores for candidate sequences of words (or words) by using the set of acoustic models for the distance D_n supplied from the selector 109, the work dictionary stored in the dictionary database 105, and the grammatical rules stored in the grammar database 106. Clearly, the calculation is not performed on the acoustic models. Instead, the calculation of the language scores and the acoustic scores for candidate sequences of words is performed by using the set of acoustic models. A person of ordinary skill in the art would appreciate that the configuration of Asano does not contemplate a memory configured direction-dependent acoustic models that are adjusted to a plurality of directions at intervals as recited in independent claim 1. As a result, Asano also fails to teach or suggest, "a speech recognition module configured to recognize the features extracted by the feature extractor as character information using the acoustic model composed by the acoustic model composition module," as recited in independent claim 1.

Furthermore, paragraph [0114] describes that in the example shown in FIG. 9, the voice recognition unit 41B includes N acoustic model databases 104_1, 104_2, . . . , 104_n, wherein *acoustic models* of speeches uttered by a sound source *are produced while*

varying the distance between the microphone and the sound source, and a set of acoustic models obtained for a particular distance is described in one database, and another set of acoustic models for a different distance is described in another database, and so on. However, Asano is devoid of any teaching or suggestion describing, "an acoustic model composition module configured to *compose* an acoustic model *adjusted to the sound direction... based on the direction-dependent acoustic models in the acoustic model memory...wherein the acoustic model composition module is configured to compose an acoustic model for the sound direction*," emphasis added, as recited in independent claim 1. Clearly, the portion of Asano referred to in the Office Action is limited to describing that the acoustic models are produced by varying the distance of the microphone and the sound source. In Asano, the acoustic models are selected rather than being composed. Nothing in this paragraph of Asano, or other paragraphs, is there a teaching or suggestion that would enable a person of ordinary skill in the art to producing the acoustic models described in Asano by adjusting them to the sound direction, based on the direction-dependent acoustic models.

The Abstract of Asano describes that the speech recognition unit 41B has plural sets of acoustic models *produced from speech data* obtained by capturing speeches uttered at various distances. From those sets of acoustic models, the speech recognition unit 41B *selects a set of acoustic models produced from speech data uttered at a distance closest to the distance determined* by the distance calculator 47, and the speech recognition unit 41B performs speech recognition using the selected set of acoustic

models. (Emphasis added) The entire focus of Asano in recognizing speech is distinct from the features recited in independent claim 1. Rather than providing a system in which an acoustic model composition module is configured to compose an acoustic model adjusted to the sound direction based on the direction-dependent acoustic models in the acoustic model memory, the acoustic models in Asano are simply produced from speech data closest to a distance determined. Asano does not teach or suggest that the acoustic model composition module is configured to compose an acoustic model for the sound direction. Rather, in Asano, the acoustic models are selected. Therefore, Asano does not teach or suggest the features associated with the acoustic model composition module recited in independent claim 1.

The Office Action recognized that Asano does not teach storing direction-dependent acoustic models in its acoustic model memory. It is fundamental that rejections under 35 U.S.C. §103 must be based on evidence comprehended by the language of that section. *See In re Lee* 61 USPQ2d 1430 (CA FC 2002) (*citing In re Grasselli*, 713 F.2d 731, 739, 218 USPQ 769, 775). In the instant case, the Office Action has limited the extent of the evidence by simply concluding that "it would have therefore been obvious to one with ordinary skill in the art at the time the invention was made to not only store distance-dependent acoustic models in the memory as is done here in modules 104 in Fig. 9, but also direction-dependent acoustic models obtained by using the stored distance-dependent acoustic models in obtaining the direction of sound using the methods of 129..." No evidence was provided in the Office Action to support such

holding. Applicants respectfully note that the mere fact that Asano includes a memory and describes methods, that alone cannot teach or suggest all the particular features associated with the acoustic model memory of the present invention.

Applicants respectfully request to the U.S. Patent and Trademark Office <u>that supporting evidence be provided</u>. The Federal Circuit has cautioned that an Examiner must show reasons that the skilled artisan, confronted with the same problems as the inventor and with no knowledge of the claimed invention, would select the elements from the cited prior art references for combination in the manner claimed. *In re Rouffet*, 47 USPQ2d 1453, 1458 (Fed. Cir. 1998). Mere allegations that "direction-dependent acoustic models" phrase in the last limitation of claim 1 is to be replaced with "distance-dependent acoustic models" and ¶ 114 is not sufficient. In particular, when the referred paragraph of Asano does not teach or suggest "an acoustic model memory configured *to store direction-dependent acoustic models that are adjusted to a plurality of directions at intervals*," emphasis added, as recited in independent claim 1.

While "Official Notice" may be relied upon, as noted in MPEP §2144.03, these circumstances should be rare when an application is under final rejection or action under 37 CFR §1.113. According to MPEP 2144.03, "the examiner may take official notice of facts outside of the record which are capable of instant and unquestionable demonstration as being 'well-known' in the art," emphasis added. However, if the Applicant, according to MPEP 2144.03 traverses such an assertion the Examiner should cite a reference in support of his or her position. In short, the rules of the U.S. Patent and Trademark Office

do not allow discretion on the part of the Examiner. Accordingly, Applicants traverse such rejection and requests that either the Examiner must support his assertion with an Affidavit or withdraw the rejection.

The outstanding rejection would appear to have taken the teachings of the present invention and applied the same to modify Asano, as set forth in the Office Action, to then disclose the presently claimed invention. Applicants respectfully assert that the *prima facie* burden has not been met. Because the Office Action has made an express admission that Asano does not teach or suggest all the claimed features of the independent claims, Applicants respectfully request that the rejection to the claims be withdrawn.

In addition, on page 3 of the Office Action, it is stated that "where the examiner had clarified that point by replacing 'direction-dependent acoustic models' phrase in the last limitation of claim 1 with 'distance-dependent acoustic models and ¶ 114." This is another indication that rather finding a single reference that describes all the features recited in the independent claims, the examiner has opted to make his own modifications to the description of Asano and the features recited in the claims to then improperly declare that Asano describes all the features of the independent claims. Such claim construction is improper and against the current state of the U.S. patent law.

Therefore, Applicants respectfully submit that claim 1 patentably distinguishes over Asano in light of the deficiencies discussed above.

Claims 4, 6 and 7 include the patentable features of base claim 1 by virtue of their dependency. Therefore, Applicants respectfully submit that these claims also patentably distinguish over Asano for at least the same reasons as base claim 1.

Claims 2, 3, and 8-12 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Asano in view of Ito (U.S. Patent No. 7,076,433). Applicants respectfully traverse this rejection as follows.

Independent claims 2 and 8 recite, in part, "a sound source localization module which localizes configured to localize a sound direction corresponding to the specified speaker based on the acoustic signals detected by the plurality of microphones;... a feature extractor configured to extract features of the speech signals separated by the sound source separation module; an acoustic model memory configured to store direction-dependent acoustic models that are adjusted to a plurality of directions at intervals; an acoustic model composition module configured to compose an acoustic model adjusted to the sound direction, which is localized by the sound source localization module, based on the direction-dependent acoustic models in the acoustic model memory, the acoustic model composition module is configured to store the acoustic model in the acoustic model memory; and a speech recognition module configured to recognize the features extracted by the feature extractor as character information using the acoustic model composed by the acoustic model composition module." Because independent claims 2 and 8 recite similar features as those recited in independent claim 1,

Applicants hereby incorporate the arguments previously submitted to support the patentability of independent claim 1 in view of Asano to support the features of independent claims 2 and 8.

Ito generally describes extracting frequency component candidate points even though frequency and/or amplitude for a target signal and noises contained in a mixed input signal change dynamically (*See* Ito at col. 2, lines 14-17). In particular, Ito describes separating a target signal from a mixed input signal even though the frequency component candidate points for the target signal and noises are located close to each other.

However, similarly to Asano, Ito is devoid of any teaching or suggestion of a sound source localization module configured to localize a sound direction corresponding to the specified speaker based on the acoustic signals detected by the plurality of microphones recited in independent claims 2 and 8. Furthermore, similarly to Asano, Ito is silent as to teaching or suggesting, at least, "an acoustic model memory configured to store direction-dependent acoustic models that are adjusted to a plurality of directions at intervals" and "an acoustic model composition module configured to compose an acoustic model adjusted to the sound direction... based on the direction-dependent acoustic models in the acoustic model memory, the acoustic model composition module is configured to store the acoustic model in the acoustic model memory...," as recited in independent claims 2 and 8.

Nothing in Ito teaches or suggests that an apparatus or a method may use a speech recognition module configured to recognize the features extracted by the feature extractor as character information using the acoustic model composed by the acoustic model composition module.

Because Ito does not cure the above-mentioned deficiencies of Asano, claims 2 and 8 patentably distinguishes over the combination of Asano and Ito.

Claims 3 and 9-12 include the patentable features of their respective base claims by virtue of their dependency. Therefore Applicants respectfully submit that these claims also patentably distinguish over Asano and Ito for at least the same reasons as their respective base claims.

Claim 5 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Asano in view of Ito and further in view of Okuno (U.S. Patent No. 7,035,418). Applicants respectfully traverse this rejection.

The Office Action took the position that Asano and Ito discloses all of the features of claim 5, except for "separate speeches by a narrower directional band when a sound direction, which is localized by the sound source localization module, lies close to a front, which is defined by an arrangement of the plurality of microphones," and "separate speeches by a wider directional band when the sound direction lies apart from the front" (*See* Office Action at page 12). In an attempt to cure these deficiencies, the Office Action relied upon Okuno to disclose the above-quoted features of claim 5. However,

Applicants respectfully disagree with the Office Action's position based on the discussion below.

Asano and Ito are discussed above. Okuno is related to a method and apparatus for determining sound source. In particular, Okuno generally describes a sound source identifying apparatus having a sound collecting means to capture sounds from a plurality of sound sources with a pair of sound collecting microphones (*See* Okuno at col. 2, lines 5-9). However, Okuno does not cure the above-mentioned deficiencies Asano and Ito, with respect to claim 2.

Because claim 5 depends upon claim 2, Applicants respectfully submit that claim 5 patentably distinguishes over the combination of Asano, Ito, and Okuno.

Accordingly, withdrawal of the rejections is respectfully requested.

Conclusion

For at least the reasons discussed above, Applicants respectfully submit that none of the cited references, whether considered alone or in combination, disclose, either expressly, implicitly or inherently, all of the elements of the claimed invention. These distinctions are more than sufficient to render the claimed invention unanticipated and unobvious. It is therefore respectfully requested that all of claims 1-12 be allowed, and this application passed to issue.

If for any reason the Examiner determines that the application is not now in condition for allowance, it is respectfully requested that the Examiner contact, by

telephone, the applicants' undersigned attorney at the indicated telephone number to arrange for an interview to expedite the disposition of this application.

In the event this paper is not being timely filed, the applicants respectfully petition for an appropriate extension of time. Any fees for such an extension together with any additional fees may be charged to Counsel's Deposit Account 50-2222.

Respectfully submitted,

/Alicia M. Choi/

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Alicia M. Choi
Attorney for Applicants
Registration No. 46,621

Customer No. 32294
SQUIRE, SANDERS & DEMPSEY L.L.P.
14th Floor
8000 Towers Crescent Drive
Vienna, Virginia 22182-6212
Telephone: 703-720-7800
Fax: 703-720-7802

AMC:dk